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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/028,144	12/20/2001	Albert C. Marshall	SD6411/S92463	2346

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EXAMINER

DOUGHERTY, THOMAS M

ART UNIT

PAPER NUMBER

2834

DATE MAILED: 04/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/028,144	Applicant(s) MARSHALL ET AL.	
	Examiner Thomas M. Dougherty	Art Unit 2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-55 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 35-55 is/are allowed.
- 6) ☒ Claim(s) 1-22 and 25-34 is/are rejected.
- 7) ☒ Claim(s) 23 and 24 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>1201</u> . | 6) <input type="checkbox"/> Other: _____ |

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5-11, 22, 25-34 are rejected under 35 U.S.C. 102(b) as being anticipated by Rason et al. (US 3,843,896). Rason et al. shown(e.g. fig. 1) a self-powered microthermionic converter comprising: an emitter electrode (28), a collector electrode (42) separated from said emitter electrode by a micron-scale interelectrode gap (see col. 5, ll. 2-8); a self-powered thermal power source (22) in thermal contact with said emitter electrode (28), means for removing electrons emitted by the emitter electrode (28), and means for returning the emitted electrons to the collector electrode (42). Note that as the device may function as a battery it is part of a closed circuit.

Said interelectrode gap comprises a vacuum. See col. 5, ll. 52-56.

Said interelectrode gap comprises an encapsulated, low pressure, vapor system, wherein the vapor coats the electrode surfaces, resulting in a reduced work function.

Said vapor is selected from the group consisting of cesium and barium vapors. See col. 5, ll. 51-53 and col. 7 ll. 44-53.

Said thermal power source (22) comprises a radioactive isotope (col. 5, ll. 22-25).

Said radioactive isotope comprises an alpha-emitting isotope selected from the group consisting of Curium-242, Curium-244 (col. 5, ll. 60-62), and Polonium-210.

A thermionic emissive material is used in the composition of an electrode selected from the group consisting of the emitter electrode and the collector electrode.

The thermionic emissive material comprises an alkaline earth oxide. See col. 2, ll. 43-48.

The microthermionic converter of claim 1, additionally comprising a thermal heat barrier (30).

A temperature for operation is between approximately 850K and approximately 1200K. Note that the range cited by Rason et al. includes this range. See col. 2, ll. 55-59.

Said temperature for operation is between approximately 1100K and approximately 1200K. See the above paragraph for location of the discussion in Rason et al.

Said collector electrode (42) and emitter electrode (28) comprise a diode. For example see the brief description of figure 3 where it is noted that the device is a "thermionic diode converter".

The microthermionic converter additionally comprises a fuel cup (24).

Said fuel cup (24) comprises an outer surface and said outer surface is coated with a thermionic emissive material comprising said emitter electrode. Note that this is evident or else the thermal radiation shield (30) would be unnecessary.

Rason et al. show (fig. 1) a method of converting heat to electrical energy using thermionic electron emission comprising the steps of: providing an incorporated thermal power source (22) that is in thermal contact with an emitter electrode (28), heating the

emitter electrode (28) with the incorporated thermal power source (22), thereby causing electrons to be emitted from the emitter electrode (28), streaming electrons emitted from the emitter electrode (28)) across a micron-spaced interelectrode gap (as noted above) to a collector electrode (42), collecting the electrons reaching the collector electrode (42), providing the collected electrons to an external electrical load (as noted above), and returning the electrons to the emitter electrode (32), thereby completing an electrical circuit (as noted above).

The thermal power source comprises a radioisotope. (as noted above).

The radioisotope comprises an alpha-emitting radioisotope from the group consisting of Curium-242, Curium-244, and Polonium-210 (as noted above).

The step of placing an incorporated thermal power source (22) in thermal contact with an emitter electrode (32) comprises enclosing the power source (22) within the emitter electrode (32).

Additionally there is a step of utilizing a heat barrier (30) on the non-diode regions of the thermal source.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-4, 12-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rason et al. (US 3,843,896). Given the invention of Rason et al. as noted above they further show their thermionic emissive material further comprising a metal selected from the group consisting of tungsten, rhenium, osmium, iridium, ruthenium, osmium, iridium, and mixtures thereof. See col. 5, m ll. 64-65. The thermionic emissive material comprises a material selected from the group consisting of tungsten, molybdenum, tantalum, tungsten oxide, molybdenum oxide, tantalum oxide, and mixtures thereof. See col. 5, ll. 64-65. Rason et al. however don't note interelectrode gaps less than about 10 micrometers, between approximately 1 micrometer and approximately 10 micrometers or between approximately 1 micrometer and 3 micrometers. 19. The dimensions of said emitter electrode are unknown.

It would have been an obvious matter of design choice to make a smaller device which would contain the claimed parts with the claimed spatial inequalities since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

Rason et al. do not note use of an alkaline earth oxide which comprises at least one material selected from the group consisting of barium oxide, strontium oxide, and calcium oxide. While they note use of aluminum oxide for various parts of their structure they do not clearly note thermionic emissive material which further comprises an adjunct oxide selected from the group consisting of aluminum oxide and scandium oxide. Rason et al. do not show a metal capping layer disposed on the thermionic

emissive material, wherein the metal capping layer comprises a material selected from the group consisting of scandium, scandium oxide, and mixtures thereof.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use any of the cited thermionic emissive materials claimed, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Allowable Subject Matter

Claims 23 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The thermal heat barrier of the prior art does not show or fairly suggest use of a micro heat barrier comprising a plurality of microspikes. The prior art does not suggest or show application of an electrically insulating material disposed between non-interacting portions of said emitter electrode and collector electrode.

Claims 35-55 are allowed.

The following is an examiner's statement of reasons for allowance: The prior art fails to show or fairly suggest, at a minimum, the feature of forming at least one fuel cup through the substrate.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

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accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The remaining prior art reads on at least some aspects of the claimed invention.

tmd
tmd Direct inquiry concerning this action to Examiner Dougherty at (703) 308-1628.

April 9, 2003

Thomas M. Dougherty
THOMAS M. DOUGHERTY
PATENT EXAMINER
GROUP 1
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